Manual #3263-40 B

konel

KR-85SB / KR-86SB
KR-87SB

SINGLE SIDEBAND
RADIOTELEPHONE

OPERATION & SERVICE MANUAL

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KR-85SB, KR-86SB, KR-87SB

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SECTION I

GENERAL INFORMATION

NOTE:

Information in this manual applies equally to Models KR-85SB, KR-86SB and KR-87SB except where noted.

DESCRIPTION

The KONEL Models KR-85SB, 86SB, and 87SB, Single-Sideband radio-telephones are intended to provide communications between ships and from ships to private or public shore stations. The units provide up to 8 channels in the marine frequency bands 1.6 to 8 megacycles. Each channel may be programmed to automatically transmit and receive the desired mode; AM (amplitude modulation); SSB with pilot carrier, or SSB with suppressed carrier.

Nominal power output is 100 watts PEP when transmitting SSB. Power output when transmitting AM (Carrier plus upper sideband) is 25 watts.

The KR-85 meets or exceeds all applicable FCC requirements. When properly installed and adjusted, improper use of the front panel controls cannot result in unauthorized modes of operation on any channel.

With exception of three power tubes used in the transmitter section of the radiotelephone, the unit is fully solid state to reduce power drain and provide long trouble-free equipment life.

The equipment is a complete single-package unit intended for shelf or bulkhead mounting. The aluminum cabinet is easily removed for routine maintenance and service.

The Model KR-85SB is designed for operation from a nominal 12.6 volts DC power source. Model KR-86SB operates from a nominal 34 volts DC source, and the KR-87SB from a nominal 24 volts DC. The three units are identical in physical size and weight

EQUIPMENT FURNISHED

1. KR-85SB, KR-86SB or KR-87SB radiotelephone
2. Power supply interconnecting plug
3. Microphone
4. Instruction manual with circuit diagrams

ACCESSORIES AVAILABLE

a
1. Quartz crystals for each operating channel
2. 6 or 8 MHz modification Kit, P/N 4275-010
3. Handset and hanger

SPECIFICATIONS

Number of channels - 8

Frequency Range - 1.6-3.0 MHz
4 MHz marine band
6 MHz marine band
8 MHz marine band

Modes of transmission -

A3h - Carrier plus upper sideband
A3a - Pilot carrier plus upper sideband
A3j - Upper sideband, suppressed carrier

Modes of reception -

SSB - 2.1 KHz received bandwidth with reinserted carrier
AM - 6.5 KHz received bandwidth

Frequency stability - ± 20 cps (transmit and receive)

Frequency Control - Type CR 27/U crystals in precision oven, Konel P/N 2176.

Spurious Emissions - Exceeds FCC requirements under parts 81, 83, 85, 87, and 91.

Power Output - 100 watts PEP (SSB)
25 watts (AM)

Output Impedance -

1. Standard marine whip antenna. Built in loading coil for antenna with electrical length less than 1/4 wave.

2. Optional 50-ohm coaxial-cable output.

Receiver Sensitivity - Better than 1.5 uv for 12 db (S+N)/N ratio (SSB)
Better than 3.0 uv for 11 db (S+N)/N ratio (AM)

Receiver Selectivity - 6 db down: 2.1 KHz (SSB) 6.5 KHz (AM)
60 db down: 5.0 KHz (SSB) 24 KHz (AM)

Spurious Rejection: Better than 60 db down.

Power Requirements -

	KR-85SB	KR-86SB	KR-87SB
Receive only	12.6V @ 1.5A	34V @ .3A	24V @ .8A
Transmit standby	12.6V @ 3.1A	34V @ 1.0A	24V @ 1.6A
Transmit speech	12.6V @ 18A	34V @ 7.0A	24V @ 10A

Mechanical -
Radiotelephone Dimensions: 5 1/4" H X 11" W X 17 3/4" L
Radiotelephone weight: 16 1/2 lbs.

SECTION II

OPERATION

NOTE:

Information given in this section applies also to type KR-86 and KR-87SB except as noted.

CAUTION:

DO NOT ATTEMPT TO TRANSMIT UNTIL THE RADIOTELEPHONE IS WARMED UP FOR AT LEAST 15 MINUTES. The crystals that control the transmitting frequency are contained in precision ovens that require at least 15 minutes to rise to correct temperature. Transmitting before the 15 minute warm-up period has elapsed can cause a violation of FCC regulations.

GENERAL

The KR-85SB Single-Sideband Radiotelephone will provide communications between ships and from ships to private or public shore stations. The method of operating the unit is simple and straight-forward but the following information on the front-panel controls should be carefully studied to insure optimum performance.

No attempt to operate the unit should be made until it has been properly installed and tested by a licensed technician. Your station log book must contain an entry that the set has been installed and adjusted by a licensed technician.

The operator of this radiotelephone must hold a valid third-class operator's license. He may permit unlicensed persons to speak over the transmitter under certain conditions. Refer to applicable FCC Rules and Regulations.

FRONT PANEL CONTROLS

The KR-85SB is designed to prevent the transmission of unauthorized modes of frequencies regardless of the front-panel control settings. However, only by correctly operating the various controls will optimum performance be obtained. Make certain that the function of each control is understood before operating the set.

VOLUME - POWER OFF

This control combines the power on-off switch and the receiver volume control. With the control fully counter-clockwise, all power to the radiotelephone is removed. Rotating the control clockwise past the click turns the equipment on and the receiver will operate immediately without warm-up. Turn the control about midway and then adjust for the desired speaker loudness when a station is received.

CLARIFIER

This control is used when receiving single-sideband stations to "fine tune" the receiver for best clarity. Adjust until the voice being received sounds natural and clear. The control serves no function when receiving AM stations.

SQUELCH

The Squelch control is provided to eliminate annoying background noise when no station is being received. The control should be first turned fully clockwise and then slowly counter-clockwise until background noise just disappears. Do not turn the control past this point since this would cause transmissions from weak stations to be missed.

METER

The meter provides an indication of actual transmitter radiation. On Channels programmed for AM, the meter will indicate when the microphone button is pressed, increasing in reading when the microphone is spoken into. On SSB channels, the meter will indicate only when speech is being transmitted. In most cases, meter action will be greater on some channels than others. This is normal and does not indicate defective performance of one channel as compared to another.

TRANSMITTER - ON SWITCH

The transmitter-on switch is provided to enable the radiotelephone to function as a receiver only at greatly decreased power drain. With the switch in OFF position, the heater power is removed from the transmitter tubes and power drain from the ship's battery is lowered. The receiver portion of the set continues to function normally. When it is desired to transmit, the switch should be operated to ON position. Allow 30 seconds for the transmitter tubes to warm up before pressing the microphone button. Note that the crystal ovens are kept on even with the switch in OFF position so that it is not necessary to wait 15 minutes after switching to ON before transmitting.

The switch should be left in OFF position when it is not expected that the transmitter will be used within the next half hour. This will increase the life of the transmitter tubes considerably.

CHANNEL SELECTOR

The channel to be used is selected by the Channel Selector. The actual channel frequencies will be labelled on the front panel at the time of installation. It will not be possible to operate the transmitter on a channel without proper crystals installed. The Channel Selector should never be switched with the microphone button pressed since this can damage the switch mechanism.

NOISE LIMITER

The KR-85SB is equipped with a noise limiter to reduce the effects of electrical noise generated by the ship's ignition and generator systems. When desired, the noise limiter action can be activated by pulling outward on the Squelch knob.

Since the noise limiter distorts the incoming signal somethat, better readability is usually obtained by turning off the noise limiter when electrical noise is not severe.

OPERATING THE SINGLE-SIDEBAND TRANSMITTER

Operating the single-sideband (SSB) Radiotelephone is quite similar to conventional AM equipments. After the desired channel is selected, press the microphone button and begin speaking. Speak in a normal tone of voice with the microphone held close to the mouth. DO NOT SHOUT. The transmitter incorporates an Automatic Level Control that adjusts the unit for variations in the voice level. Shouting is not necessary; it does not increase transmitter output and only garbles the signal so that intelligibility is reduced. The front panel meter should swing with each syllable spoken.

Remember that no carrier is being transmitted. Even though the microphone button is pressed, no signal appears on the air until you begin speaking. You cannot acknowledge a transmission from the other station by merely "blipping" the button; the receiving station will hear nothing until you actually speak.

SECTION III

INSTALLATION

NOTE:

Information given in this section also applies to type KR-86SB and KR-87SB except as noted.

GENERAL

Installation of the KONEL KR-85SB consists of locating and mounting the Radiotelephone, installing a suitable antenna and ground system, and installing any desired remote operating facilities.

RADIOTELEPHONE

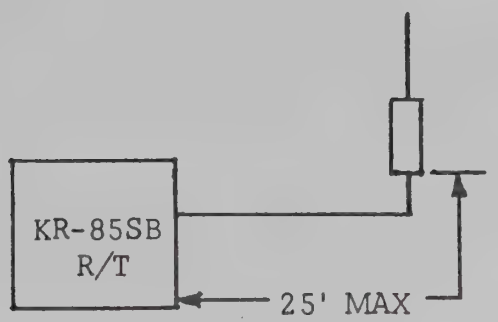
Select a convenient operating location for the Radiotelephone. The cabinet and mounting plate are reversible. Thus, the Radiotelephone may be arranged to mount on any flat surface either vertical or horizontal. The location selected should allow at least one inch of space next to the top of the cabinet for purposes of ventilation.

ANTENNAS

The KR-85SB will operate efficiently over its frequency range, in most cases, with a standard center-loaded marine whip antenna. This is made possible through the use of an antenna loading coil which is included in the basic set. Where a simple, low-cost installation is desired, this antenna configuration is recommended. To operate properly, the length of the antenna measured from the bottom of the whip antenna loading coil plus the length of antenna lead-in should not total more than 25 feet. This figure assumes that the set is connected to a good, low-impedance ground. In principle, the antenna operates as a conventional center-loaded whip in the range 2 - 3 MHz; at frequencies above 4.0 MHz, the center-loading coil appears as an r-f choke and only the lower portion of the antenna acts as a radiator. When loading the antenna it will be found that only a small amount of antenna loading coil will be needed at frequencies near 3.0 MHz. while considerably more loading coil will be needed at 4 MHz. At frequencies higher than 4 MHz, progressively less coil is needed.

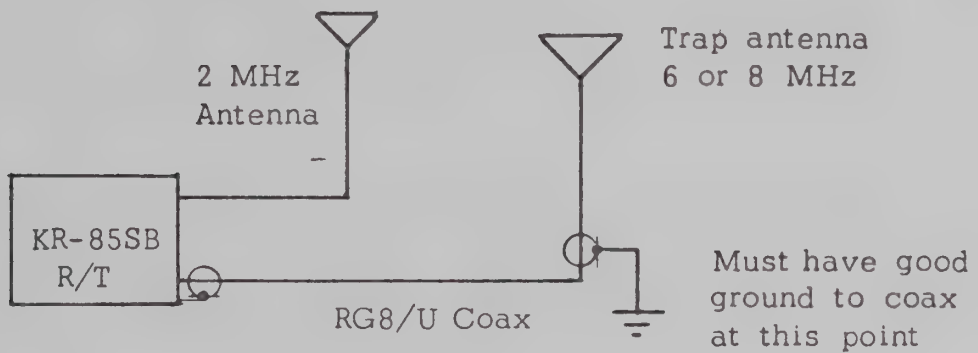
Channels are available for operation at 6 MHz or 8 MHz. If the lead-in from the center-loaded marine whip antenna is reasonably short, either of these frequencies may be efficiently loaded by using the antenna loading coil. Alternately, this channel may be fed to a "trap" type antenna with 50-ohm coaxial cable. A hole cluster suitable for mounting a standard coaxial receptacle is provided on the rear panel for this purpose. The channel switch wafer that normally adjusts inductance of the antenna loading coil may be re-connected to route the transmitted signal to the coaxial receptacle. Use RG-58/U cable for this connection.

SUGGESTED ANTENNA SYSTEMS



EXAMPLE #1

Frequency coverage: 2-8 MHz Single antenna



EXAMPLE #2

Frequency coverage: 2-4 MHz on center-loaded whip
6 or 8 MHz on trap antenna

The antenna and RF ground system used with this equipment must be carefully installed and maintained.

On wood vessels, a copper ground plate of at least 30 square feet should be attached to the outside of the hull. Studs should be brazed to each end of the plate to serve as connections to the radiotelephone. Connections should be as short as possible and should be made with flat copper strap two or more inches wide.

If a long ground is necessary, two or more separate runs of flat strap should be used to each stud. The ground system may be improved by bonding all metal objects in the vicinity of the installation to the ground strap. Bonding connections should be soldered if possible.

NOISE SUPPRESSION

The KR-85SB incorporates a highly sensitive receiver which responds to interfering electrical noise much the same as conventional AM receivers. While the use of the Squelch control and noise limiter will alleviate much of the annoyance of noise, optimum performance can only be obtained if the electrical system of the vessel is treated for suppression of noise. The techniques to be used are identical to those used for a conventional AM installation and include bypassing and filtering of the generators or alternators, and installing radio suppressors or shielding the ignition wiring.

After the installation has been noise suppressed as much as possible, it is wise to instruct the owner in the use of the automatic noise limiter control (part of the Squelch control). The ANL system operates in both the AM and SSB receiving modes and materially assists in receiving weak stations. Additionally an RF Gain control is provided to optimize the receiver to the existing noise environment. The control is located on the vertical Crystal Oscillator board just rearward of the crystal oven. With the set operating and the ships electrical systems operating, adjust the control counter-clockwise until any evidence of blocking due to noise pulses disappears.

ANTENNA TUNE-UP

Initial programming and alignment procedures are detailed in Section 5 of this manual. Do not attempt to load the radiotelephone to the ship's antenna until preliminary alignment has been accomplished.

1. Install the set as close as possible to the final position. Remove the top half of the cabinet. Connect a 0-3 A R-F Ammeter with short leads in series with the antenna lead-in.

2. Turn the set on and allow 15 minutes for oven warm-up.

3. Place the TUNE-OPERATE switch in TUNE position. Press the Microphone button and adjust the appropriate tap on the Antenna Load Coil (L109) for maximum indication on the Ammeter. Secure the tap.

4. Adjust the appropriate PA LOAD capacitor for maximum Ammeter indication.

5. Return the TUNE-OPERATE switch to OPERATE position. This completes tune-up procedure for channels programmed for A3A and A3J modes. For channels operating in the A3H (AM) mode, perform the following step.

6. With the TUNE-OPERATE switch in TUNE position, press the microphone button and note the R-F Ammeter reading. Then adjust the switch to OPERATE position and press the microphone button. Adjust the appropriate TX DRIVER trimmer until the Ammeter reading is 60% of that obtained with the switch in TUNE position. To decrease the Ammeter reading, turn the trimmer clockwise; to increase the Ammeter reading, turn the trimmer counter-clockwise.

NOTE:

The microphone gain control has been factory set for average conditions and may need adjustment to suit the owner's voice and the background noise level of the vessel. The control is located on the underside of the chassis (see illustration in section 6 of this manual for exact location) Turn the control clockwise to reduce microphone gain.

On channels programmed for a 50-ohm antenna, a thru-line wattmeter should be used. Follow antenna manufacturer's recommendations to minimize reflected power. The transmitter should not be retuned during adjustment of 50-ohm antennas.

SECTION IV

THEORY OF OPERATION

NOTE:

Information in this section applies equally to Models KR-85SB, KR-86SB, and KR-87SB, except where noted.

GENERAL

This section assumes that the reader is familiar with the operation of conventional AM transmitters and receivers. Special emphasis is given to those parts of the Radiotelephone which differ from the circuits customarily used in AM equipment.

SINGLE-SIDEBAND TRANSMISSION AND RECEPTION

The Single-sideband (SSB) transmitter differs from its AM Counterpart in two important respects. Modulation is applied to the outgoing signal in a low-level stage and then amplified by a series of stages to the final output level. The low-level modulated signal cannot be multiplied to the final output frequency; it must be converted to the desired frequency by mixers.

The SSB receiver differs from an AM receiver only in the type of detector circuit used and special treatment which must be applied to the AGC system.

BLOCK DIAGRAM

Referring to figure 4-1, a signal arriving at the antenna is passed through a circuit resonant at the signal frequency and applied to an RF amplifier. The amplified signal is then fed through another resonant circuit to a mixer stage which converts the incoming signal to either 455 KHz or 5.1 MHz. The choice of intermediate frequency depends upon the injection frequency supplied to the mixer. Mixer output is applied to filters with passbands of 2.1 KHz (5.1 MHz SSB) and 6.5 KHz (455 KHz AM).

On a channel programmed to receive AM, the signal passing through the AM filter is amplified and applied to a conventional diode AM detector. Detector output is processed by a noise limiter and fed to the input of a three-stage audio amplifier and thence to the speaker.

With SSB reception programmed the signal passing through the SSB filter is amplified and demodulated by a product detector with carrier injection being received from a 5.1 MHz crystal oscillator. The recovered audio from the detector is passed through a noise limiter and amplified to speaker level.

To provide for substantially constant audio output level with varying signal input levels, a special automatic-gain-control (AGC) amplifier is included in the receiver chain. The AGC amplifier receives an input from either the product detector or the AM i-f amplifier and is arranged to produce a DC output voltage

proportional to the strength of the input signal. This voltage controls the gain levels of the r-f amplifier, the mixer and the SSB i-f amplifier. In addition, output from the AGC amplifier actuates an audio squelch system.

When the microphone button is pressed, audio output from the microphone is passed through an automatic-level control (ALC) gate and applied to a diode-quad modulator which combines the audio with the 5.1 MHz carrier to produce a suppressed-carrier output. The dual-sideband signal from the modulator is amplified by an IF amplifier and applied to the 5.1 MHz crystal filter. The filter eliminates the upper sideband and passes only the lower-sideband signal. Output from the filter is combined with a high-frequency crystal injection to produce an upper-sideband output at the desired operating frequency. Since the high-frequency is always on the "high" side of the 5.1 MHz IF frequency, the sideband produced in the output of the mixer is always inverted; thus the transmitter always emits an upper-sideband signal.

Output from the mixer is passed through a resonant circuit tuned to the desired operating frequency and applied to a driver stage. Output from the driver is passed through a second tuned circuit and applied to the grids of the power amplifier. 100 watt PEP output from the power amplifier is impedance matched to the antenna load by a pi-network coupler.

An ALC rectifier coupled to the grids of the power amplifier produces a DC output when the SSB signal reaches the level required to produce 100 watts output. This DC output is amplified and applied to the ALC gate and greatly attenuates the microphone input signal so that further output from the transmitter cannot occur. Thus, regardless of the level of speech, the transmitter is limited to the desired output.

CIRCUIT DIAGRAM

NOTE:

> In the following description, reference is made to +R lines and +T lines. A +R line connects to the 10 volt supply bus when the unit is in Receive and to ground when the unit is in Tramsmit. Conversely, the +T line connects to the 10 volt supply bus when the unit is in Transmit and to ground when the unit is in Receive.

RECEIVE FUNCTION

An incoming signal at the antenna is passed through a L-C circuit the resonant frequency of which is controlled by the channel switch. The signal is then applied to the gate of Q303 which in conjunction with Q302 operates as a cascode r-f amplifier. Output from this stage is coupled through another resonant circuit to the input of mixer Q304 and Q305 which also receives a high-frequency injection from crystal oscillator Q301. The two inputs are mixed to produce the desired intermediate-frequency output. Q303 and Q305 are gain controlled by a positive-going AGC voltage.

Output from mixer Q304 and Q305 is passed through two series-connected resonant circuits which extract two desired i-f signals. T201 is resonated to 5.1 MHz and output from this matching transformer is applied to a crystal-lattice filter which passes a 2.1 KHz band centered at 5098.5 KHz. Another resonant circuit, L201 and capacitors C236 and C237, separates an intermediate frequency component centered at 455 KHz. Output from this circuit is applied to a ceramic-disc filter which provides a 6.5 KHz passband centered around 455 KHz.

When AM reception is programmed by switch wafers S101-3, a +10 volt potential is supplied to 455 KHz i-f amplifier Q212 and Q213. This amplifier builds up the output from the AM filter to the level required for detection. Additionally, the +10 volt potential is used to bias off the SSB amplifier chain. Finally, the +10 volt potential deactivates the 5.1 MHz carrier oscillator which is not needed for detection of AM signals.

Output from the 455 KHz i-f amplifier is applied to diode detector CR209. The audio signal from the detector is passed through series-limiter CR210 which removes much of the noise interference accompanying the signal. Output from the limiter is applied to the Volume control.

When SSB reception is desired, the control lead from switch wafer S101-3 is grounded. In this condition, the 455 KHz I-f amplifier is disabled, the 5.1MHz carrier oscillator is activated and the SSB I-f amplifier is biased on. Output from the 5.1 MHz SSB filter is amplified by Q207 and Q208 and applied to Q209 with input from the 5.1 MHz carrier oscillator Q307. The two inputs are combined to produce an audio output which is passed through matching transformer T206 to a shunt clipper CR207 and CR208 that limits the amplitude of short-duration noise spikes. Audio output from the clipper feeds through R240 to the volume control.

Output from the volume control is applied directly to audio amplifier Q211. Output from this stage feeds audio driver Q210 which in turn actuates power amplifier Q103.

To equalize audio level with varying signal input levels, AGC amplifier Q214 is provided. This stage receives either a 455-KHz i-f input through C255 or an audio input through C242 and R258 from the SSB product detector. Q214 is biased near the threshold of conduction and an input signal causes it to conduct heavily. When the stage conducts, the potential on capacitor C227 rises. This potential is applied through dropping resistors to the emitters of Q303, Q305 and Q207. The gain of these stages is thus reduced as required to maintain the audio output of the receiver substantially constant. When the incoming signal is removed, the potential on capacitor C227 discharges slowly and the gain of the receiver gradually rises. This long decay effect tends to maintain receiver gain constant between syllables of an incoming SSB signal.

Output from the AGC amplifier is also applied through the SQUELCH control to the base of squelch control Q215. This stage is connected in series with the source resistor of audio amplifier Q211. When Q215 is not in conduction, the DC voltage path through Q211 is interrupted and no audio can pass through. When Q215 conducts, the circuit is completed and Q211 operates normally. In practice, the bias on the base of Q215 is adjusted by the SQUELCH control to

the threshold of conduction. In this condition, even a small rise in AGC potential causes Q215 to conduct, thus "turning on" the audio amplifier.

TRANSMIT FUNCTION

When the microphone button is pressed, relays K101 and K102 are energized. This connects the +R line to ground and the +T line to the 10-volt supply bus. In addition, the antenna is connected to the transmitter output circuit and high voltage is applied to the transmitter amplifier tubes.

In the transmit function, an audio signal from the microphone is passed through transformer T205 to the source of ALC gate Q205. The signal is also coupled through C211 to the gate of this stage. With zero bias applied to the gate, the resistance between source and drain is low and the audio signal passes readily through. When negative bias is applied to the gate, the resistance between source and drain rises rapidly and the microphone signal is greatly attenuated. Thus Q205 acts as a voltage-variable level control.

Output from Q205 is applied to the input of diode-quad modulator CR202 - CR205. Also applied is a carrier from 5.1 MHz oscillator Q307. Output from the modulator contains both sidebands of a signal centered around the 5.1 MHz carrier but with the carrier suppressed. This signal is then amplified by Q202 and applied to the SSB filter. The filter suppresses the upper sideband of the composite signal and passes only the lower sideband. When some amount of carrier is desired in the transmitter output, a small amount of 5.1 MHz carrier is amplified by Q204 and re-inserted in the output of the crystal filter. The level of re-inserted carrier is controlled by the varying of the DC bias on amplifier Q204. With no forward bias applied, output from this stage is nil and a suppressed-carrier output is obtained. With full forward bias applied, an amount of carrier is inserted to provide full RF output from the transmitter for tune-up purposes. Intermediate amounts of re-inserted carrier may be obtained by correctly setting either potentiometer R401 or R402 as programmed into the channel in use.

Output from the SSB filter (plus any re-inserted carrier) is applied to mixer Q203. Also applied to this stage is a high-frequency injection from Q306. Since this injection is always on the "high side" of the desired output frequency, the sideband appearing in the filter output is inverted. Thus, the transmitter always emits an upper sideband signal.

Output from mixer Q203 is passed through a switch-selected coil resonated to the operating frequency by a trimmer. The signal is amplified by a broadband amplifier and then impressed on the grid of driver V101.

The driver output is coupled through a switch-selected coil to the grids of power amplifier V102 - V103. This stage amplifies the signal to the desired 100 watts PEP output. Output from the power amplifier is impedance matched to the antenna load by a pi-net coupler. Additionally, an adjustable L-section tuner is provided for matching the system to short whip antennas. A parallel-resonant 5.1 MHz trap in the antenna circuit is provided to attenuate direct output from the 5.1 MHz IF signal. This trap also functions on receive to suppress any IF response through the antenna.

A portion of the signal applied to the final-amplifier grids is coupled through C131 to ALC rectifier CR102. This diode is reverse biased through R110 and R403 so that it conducts only when the positive peaks of the drive signal approach ground potential. When CR102 conducts, a positive DC output is generated which is applied to the base of ALC amplifier Q206. With the DC output applied, Q206 conducts and its collector potential drops to some value negative with respect to ground. This negative potential is then applied to ALC gate Q205 to increase the attenuation through this stage thus causing the microphone signal to be reduced to a level which results in no more than that required to produce 100 watts output.

POWER SUPPLY CIRCUITS

The power supply circuits are an integral part of the Radiotelephone. They consist of a low-voltage regulator, a power inverter and high-voltage rectifiers to supply necessary potentials to the vacuum-tube stages.

LOW-VOLTAGE REGULATOR

Voltage supplied directly from the nominal 12.6 volt DC input is filtered by R408 and C404 and applied to the collector of regulator Q401. The base potential on this stage is held constant by zener diode CR401 so that the DC output appearing on the emitter is regulated at +10 volts regardless of varying input voltage or output load current. Capacitors C402 and C403 are provided to lower the output impedance of the regulator.

POWER INVERTER

Inverters Q101-Q102 are connected in a common-emitter oscillator circuit to inverter transformer T103. Starting bias is obtained from a voltage divider consisting of R111 and the heater of V101.

HIGH VOLTAGE RECTIFIERS

The high voltage output from T113 supplies power to two rectifier-filter systems that supply necessary potentials to the vacuum-tube stages.

Rectifiers CR403-CR406 are arranged as two voltage doublers series connected. DC output from the top of this string (+800 V) supplies plate potential to V102 and V103. A +200-volt potential is taken from the one-quarter point on the string and supplies power to the screen grids of V102 and V103 and to the plate and screen grid of V101. Contacts on K101 ground the circuits supplied from the +200 bus when the set is in Receive mode to prevent transient emissions after the microphone button is released.

Rectifier CR402 is connected in a half-wave circuit to supply a -70 volt output. This negative potential supplies grid bias to the final power stages, stand-off bias to the ALC rectifier and operating potentials for ALC amplifier Q206.

24 and 34 VOLT OPERATION

Audio output from Q210 is coupled to Q104 which drives the complimentary emitter followers Q105 and Q106. Audio is coupled to the speaker by C158.

Keying relays K101 and K102 and a dropping resistor are connected in series; filaments are series connected with a balancing resistor. A series resistor is used with the panel light.

The voltage regulator is fed thru a dropping resistor to prevent overheating of Q401.

The high voltage inverter transistors Q107 and Q108 are started by a surge voltage thru R128 and C162. Bias is obtained by the alternate conduction of diodes CR112 and CR113, which clamp the associated base at - .7V thereby forcing the opposite base into conduction. Base current is limited by R129. A spike-clipping network is used on the inverter collectors.

Line filter capacitor C160 is pre-charged by R127 to minimize surge current through the power switch.

SECTION V

TEST AND ALIGNMENT

NOTE:

Information in this section applies equally to Models Kr-85SB, KR-86SB and KR-87SB except where noted.

GENERAL

The KR-85SB is normally supplied by the factory with crystals installed and aligned to the operating frequencies specified by the customer. This section will outline necessary procedures for installing added channels or changing the operating frequency of a given channel.

Complete alignment of the unit as a maintenance procedure is not recommended. Specific adjustments to various circuits that may require field attention are given in this section.

EQUIPMENT REQUIRED

The procedures given below require the use of all or a part of the following test devices:

Signal Generator, H-P 606A or equal
RF VTVM, HP-410-B or equal
Oscilloscope, 10 MHz response minimum
Frequency Counter, H-P 5245L with H-P 5261 video amplifier
Dummy load, 200 pf and 10 ohm non-inductive 50 watt resistor
Two-tone audio test generator
Audio VTVM, H-P 400AD or equal
Grid Dip Meter

CRYSTAL INSTALLATION

Install crystals as required in the crystal oven. All ship station transmitting crystals must be KONEL part No. 2176 with a frequency 5100.00 KHz higher than the operating frequency. These crystals are similar to CR-27/U, but are specially processed for long term stability. For SSB Land Stations, it is necessary to specify High-Tolerance Xmit Crystals to comply with F.C.C. rules part 81. These crystals must be KONEL part No. 2177.

Crystals for reception of single-sideband stations must be type 2176 with a frequency 5100.00 KHz higher than the desired receiving channel.

Crystals for reception of AM stations must be the desired channel frequency plus 455 KHz. They need not be special since a small frequency error will not impair reception. Provided the crystal is equipped with a type HC-6/U holder, a standard marine AM crystal may be used. Crystals for AM channels may be ordered from KONEL - part No. 2178.

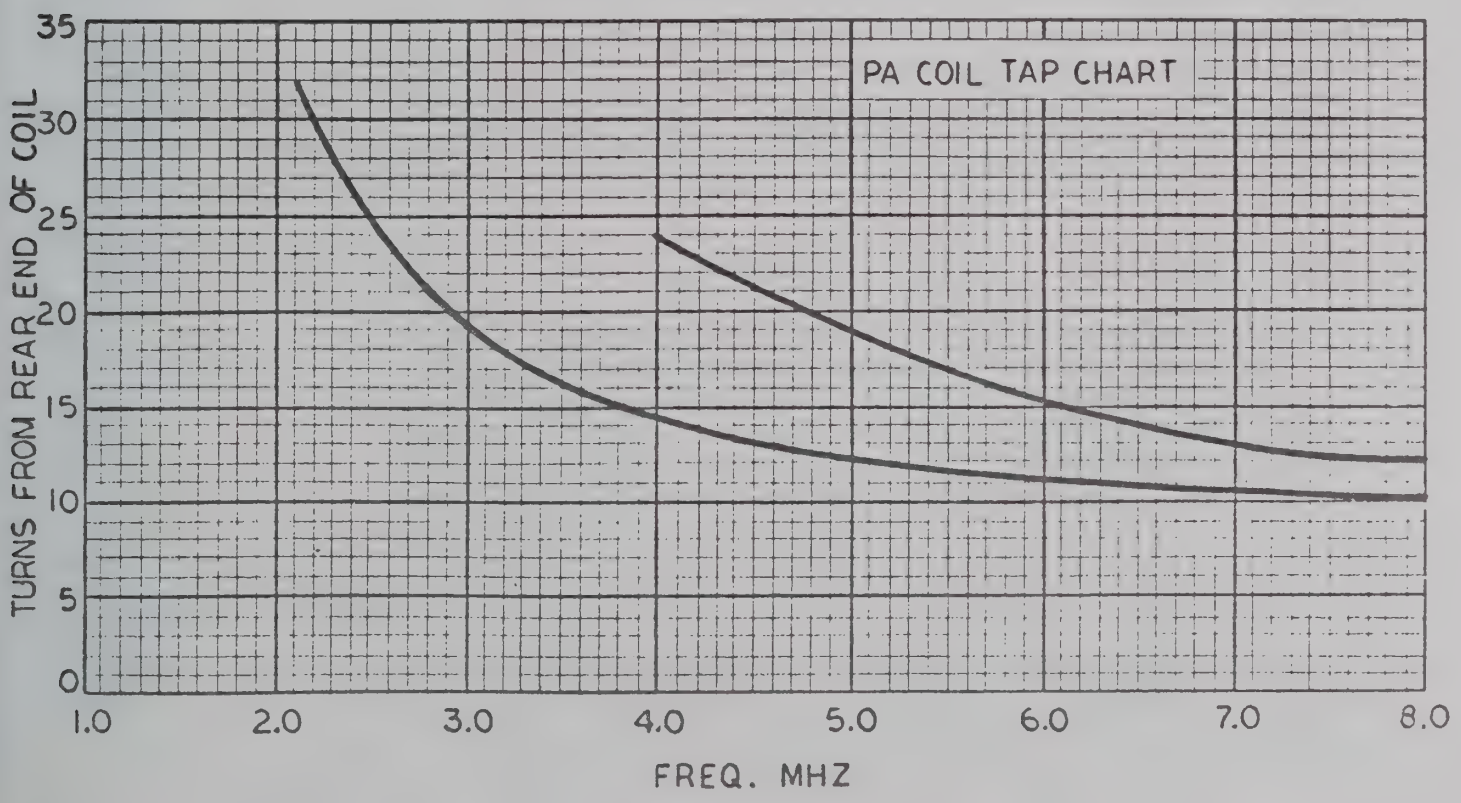
CHANNEL ALIGNMENT

The KR-85SB is equipped with all coils necessary to receive and transmit on the marine channels from 1.6 to 4 MHz. Channels may be modified to cover 6 MHz and/or 8 MHz by adding Kit No. 4270-010 and/or 4275-020. The schematic diagram shows typical programming. Units ordered from the factory with specific programming may differ from the schematic; field programming may require changing coil taps, channel switch taps, and changing padder capacitors and coils as indicated on the schematic.

NOTE:

> Operation of the KR-85 at 1.6 MHz requires parts not normally available to the dealer. If a 1.6 MHz channel is to be added, contact the factory for instructions and components.

Connect the power-amplifier tuning capacitor and the Pi-net coil tap as shown in the schematic diagram and the coil chart. Before applying power to the set, the resonant frequency of the Pi-net coil should be measured with a grid-dip meter with no antenna load connected. It may be necessary to vary the coil tap one turn either way to achieve resonance at the desired channel frequency. When installing a 6 or 8 MHz kit, the tap is selected as before and the Pi-net coil is grid-dipped after setting the tank tuning capacitor at 50% of capacity.



PROGRAMMING THE DESIRED MODE

1. Remove trimmer strip from front panel assembly to gain access to the 3rd wafer from the front. Locate the orange-white and black-white wires connected to terminals 8 and 9 (BC) of this wafer.

2. Reconnect channel jumper wire on wafer as required. Channel jumper wire is color-coded (i.e. green for channel 5). For SSB reception connect the channel jumper to the black-white wire. For AM reception connect channel jumper to the orange-white wire. Do not connect white-black to white-orange under any circumstances.

3. Locate wafer #10 (4th from rear). Leads from channel contacts are color coded, and some are connected to an adjacent tie point with lugs marked A3A (-16db pilot carrier level) or A3H (-3db carrier for AM). Leads not connected are programmed for A3J (SSB, no carrier).

4. Reconnect leads as required for A3A or A3H; leave appropriate leads disconnected for A3J.

RECEIVER ALIGNMENT

Connect a signal generator to the antenna post. Adjust the generator to the operating frequency and set output until the signal is just audible. Adjust the receiver trimmer capacitors for best audio output. Reduce the generator output as required so that AGC action does not confuse the alignment. A final trimmer adjustment should be made when the set is installed and connected to the ship's antenna. Adjust the trimmers for loudest atmospheric noise level.

Allow the receiver to warm up for at least 30 minutes. Connect a frequency counter to the junction of R307 (1 meg) and C323 (5pf). Adjust the appropriate crystal trimmer capacitor until the counter reads exactly the operating frequency plus 5100.00 KHz (SSB) or the operating frequency plus 455 KHz (AM). See that the clarifier control provides a tuning range equally divided around the center frequency.

NOTE:

> Channel crystals for AM reception quite often cannot be adjusted to the exact frequency since this type of crystal is not designed for operation at the oven temperature. If the frequency can be adjusted within 1 KHz of the correct value, operation will be satisfactory since the bandwidth of the receiver in the AM mode is 6.0 KHz or more.

TRANSMITTER ALIGNMENT

Remove the high voltage fuse (F-102) and connect a two-tone generator to the microphone input terminal. Connect an oscilloscope (with low-capacity probe) to pin 2 of V101. With the two-tone generator set at 0.5 volts p-p, press the microphone button and adjust the appropriate Xmt Mixer trimmer for maximum scope presentation.

MODE FREQ.	CHANNEL NOS.	ACTION	LOCATION
A3H	Ch. 9,2,3,4,5,6,7.	Connect to Wh/Orn. wire	Rx Mode
A3A-A3J	Ch. 1,8.	Connect to Wh/Blk. wire	Bsw. Wafer 3
A3H	Ch. 2,3,4,5,6,7.	Connect to Wh/Brn. (on T.P.)	Tx Mode
A3A	Ch. 8.	Connect to Wh/Red. (on T.P.	Bsw. Wafer
A3J	Ch. 1.	Leave open and sleeve	10
2000-3000	Ch. 1,2,3,4,5,6,7.	Connect to Brn. Wire	Rx Ant Coil
3500-6000-8000	Ch. 8	Connect to Wh/red wire	Bsw. Wafer 2
6000-8000	Ch. ------	3.5uh RFC (0904-55)	Rx Ant Trimmers
Rx			
2000-2350	Ch. 1,3.	750pf.	
2350-2400	Ch.	500pf.	Rx Mix
2400-3000	Ch. 2,4,5,6,7.	-----	Trimmers
3500-4500	Ch. 8	-----	
6000-8000	Ch. -----	3.5uh RFC (0904-55)	
Tx			
2000-2350	Ch. 1,2,3.	750pf.	
2350-2400	Ch. -----	500pf.	Tx Mix
2400-3000	Ch. 4,5,6,7.	390pf.	Trimmers
3500-4500	Ch. 8.		
6000-8000	Ch. -----	3.5uh RFC (0904-55)	
Tx			
2000-2350	Ch. 1,2,3.	750pf.	
2350-2400	Ch. -----	500pf.	Tx Driver
2400-3000	Ch. 4,5,6,7.	390pf.	Trimmers
3500-4500	Ch. 8	-----	
6000-8000	Ch. -----	3.5uh RFC (0904-55)	
Tx			
2000-3000	Ch. 1,2,3,4,5,6,7.	Connect to 2-3MHz PA TUNE cap.	P.A. Plate
3500-4500	Ch. 8	Connect to Wh. wire to H. cap.	Caps.
6000-8000	Ch. -----	Connect Coax wire to Cap/Brkt	Bsw. Wafer 8
Tx			
2000-26000	Ch. 1,2,3,4.	2200pf.	
2600-3000	Ch. 5,6,7.	-------	P.A.Load
3500-4500	Ch. 8	------	Caps.
6000-8000	Ch. -----	Replace with 0807	
6000	Ch. -----	0871 & 100pf. Cartwheel	P.A.PLATE
8000	Ch. -----	0871 cap.	Caps.

NOTE:

When tuning a channel in the range 4.0 - 8.0 MHz, it is possible to tune the Xmt Mixer stage to the i-f frequency (5.1 MHz) instead of the desired output frequency. If two responses are found within the tuning range of the trimmer, select the output requiring more trimmer capacity (adjustment screwed more clockwise) on 4.0 MHz channels. Select the output requiring less capacity (adjustment screwed more counter clockwise) for channels operating at 6 or 8 MHz.

Re-insert the high voltage fuse and move the scope probe to pin 5 of V102. Depress the microphone button and adjust the appropriate Transmit Driver trimmer for maximum scope presentation. If the presentation appears to be "clipped" on the positive-going peak of the envelope, turn the trimmer further clockwise until the clipping disappears. Touch up the Xmt Mixer trimmer for maximum scope display.

Connect the antenna (or equivalent dummy load) to the antenna post. Adjust the Antenna Loading Coil tap for maximum current into the antenna as indicated by the panel meter or an r-f ammeter inserted in the antenna lead. Loosely couple the scope to the antenna lead and observe that the two-tone pattern is clean and without evidence of "flat-topping". If flat-topping occurs, increase loading by adjusting the PA LOAD capacitor counter clockwise. With proper loading and rated input voltage, the voltage measured at pin 5 of J101 will be -0.8 volts dc with a two-tone audio input. With a sustained whistle into the microphone the voltage at pin 5 of J101 will be approximately -1.1 volts.

Disconnect two-tone generator and allow the set to warm up for at least 30 minutes to stabilize the crystal oven. Loosely couple the counter to the antenna post and switch the TUNE-OPERATE switch to TUNE position. (This position causes the transmitter to emit full output at the carrier frequency). Depress the microphone button and adjust the appropriate transmit crystal trimmer until the counter indicates exactly the assigned carrier frequency.

ADJUSTING CARRIER LEVEL

The two carrier level adjust potentiometers (R401 and R402) are factory preset and should not be used to set carrier level on a newly activated channel. When setting up a new channel it is necessary to adjust the overall transmitter gain of that channel until it is equal to that of other channels. This is accomplished by slightly detuning the Xmt Driver trimmer for that stage. Detuning should always be made in the clockwise direction so that more capacity is added to that required to resonate the stage.

With a two-tone signal applied, observe the peak-to-peak deflection with the scope loosely coupled to the antenna post when full output is being delivered. Then remove the two-tone input and adjust the Xmt Driver trimmer until the following p-p deflection is obtained:

A3H (AM) - 2/3 deflection

A3A (Pilot Carrier) - 1/6 deflection

If readjustment of carrier level controls R401 or R402 are required, proceed as follows:

1. A3H (AM compatable).

   a. Adjust R402 fully counterclockwise and apply 2-tone audio. Key transmitter and tune for maximum output as on an A3J channel. Observe pattern on oscilloscope loosely coupled to antenna.

   b. Remove one tone (keeping the level of the second tone constant) and adjust R402 clockwise until a 2-tone pattern is again observed. Continue advancing R402 past the adjustment indicating a clean null, until approximately 10% carrier remains at the trough of the wave shape.

2. A3A (-16db Pilot carrier).

   a. Adjust R401 fully counter clockwise and apply 2-tone audio. Key transmitter and tune for maximum output as on an A3J channel. Observe pattern on oscilloscope loosely coupled to the antenna and note height of peak signal.

   b. Remove 2-tone audio. Advance R401 until carrier is 1/6 the height of the peak noted above.

3. A3J (SSB)

   a. When a channel is operated in the A3J mode (suppressed carrier) the Xmt Driver trimmer is used to set the microphone gain to the desired level. Speak into the microphone in a normal voice tone and adjust trimmer clockwise until voice peaks as observed on the scope just reach full deflection.

NOTE: Proximity of the cabinet cover to the final amplifier tank coil and loading coil causes a slight detuning effect which may be noticeable on some channels.

FIELD ADJUSTMENTS

The following adjustments can be made with the test equipment listed at the start of this section:

5.1 MHZ TRAP

Adjust unit to receive on a SSB programmed channel. Connect signal generator to antenna receptacle and set for high output. Tune signal generator near 5.1 MHz until response is heard in speaker. Tune 5.1 MHz trap capacitor (C139) for minimum receiver output.

CARRIER BALANCE

Accurate carrier balance is important only if transmitter is to be operated

in full SSB mode. Set unit to transmit on a channel programmed to transmit full SSB. Connect dummy load to antenna terminals. Connect scope to 5.1MHz trap coil, press microphone button but muffle microphone so that no microphone output is obtained. Scope will indicate residual carrier. Alternately adjust Carrier Balance Potentiometer (R210) and Carrier Balance Trimmer (C205 or C206) for minimum scope reading. Scope should indicate a residual output less than one hundredth that of full power output. NOTE: Allow 30 minutes warm-up before making this adjustment.

ALC ADJUSTMENT

Set the unit to transmit on the highest frequency in use. Connect the dummy load to the antenna receptacle and the scope across the dummy load resistor. Connect the two tone audio generator to the microphone terminals. Press the microphone button and observe the appearance of the two-tone pattern on the oscilloscope. If evidence of "flat-topping" is noted, readjust the ALC control slightly until it just disappears. NOTE: Some instability of the two-tone pattern will be observed with the two-tone generator set at very high input levels. This is caused by audio distortion introduced by the ALC gate as its bias approaches cutoff. This distortion can be ignored since it does not affect clarity of speech.

TUBE REPLACEMENT

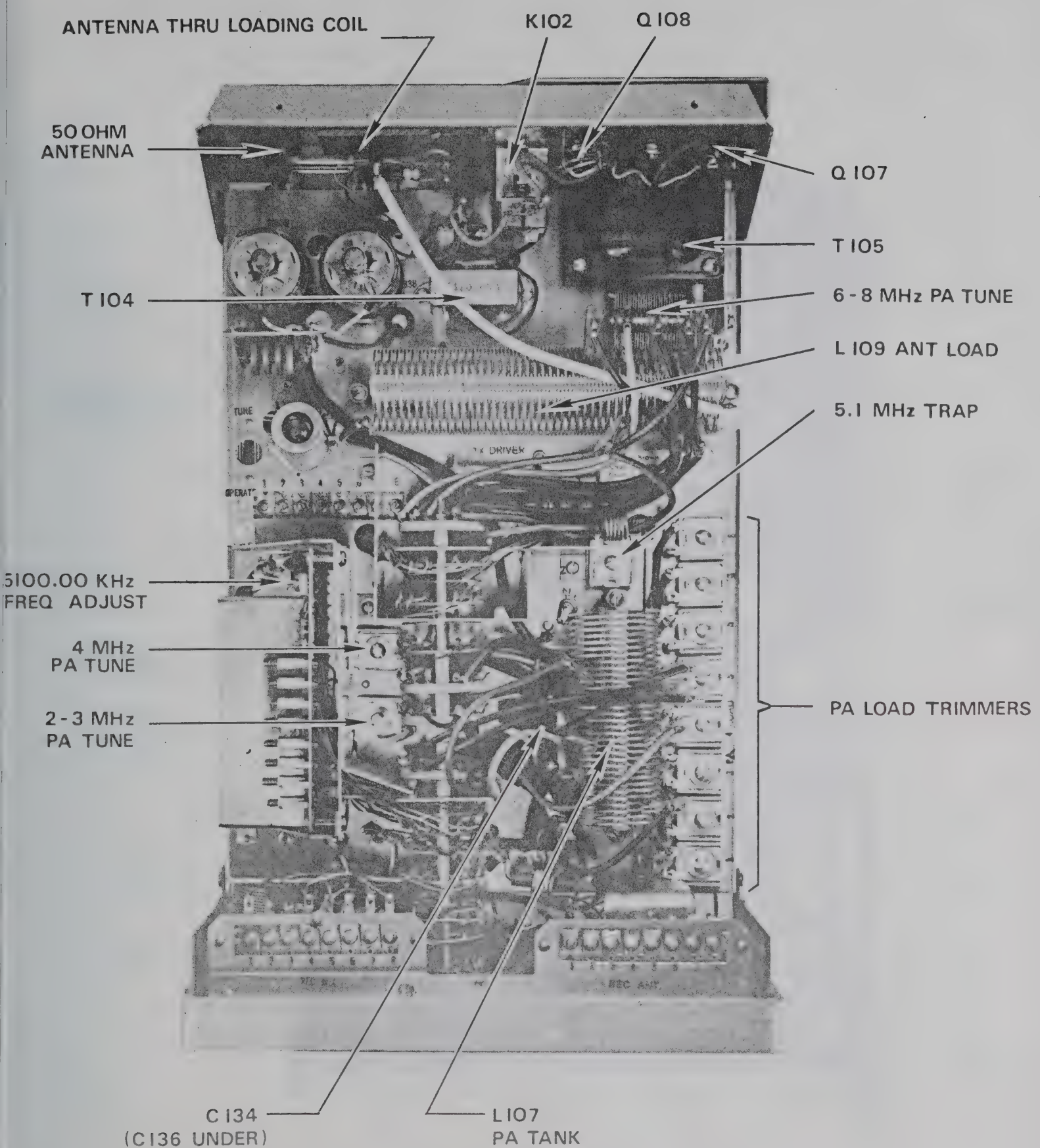
The driver and final-amplifier tubes may require replacement after many hours of operation. Evidence of weak tubes will be lack of microphone gain and low transmitter output.

TROUBLESHOOTING

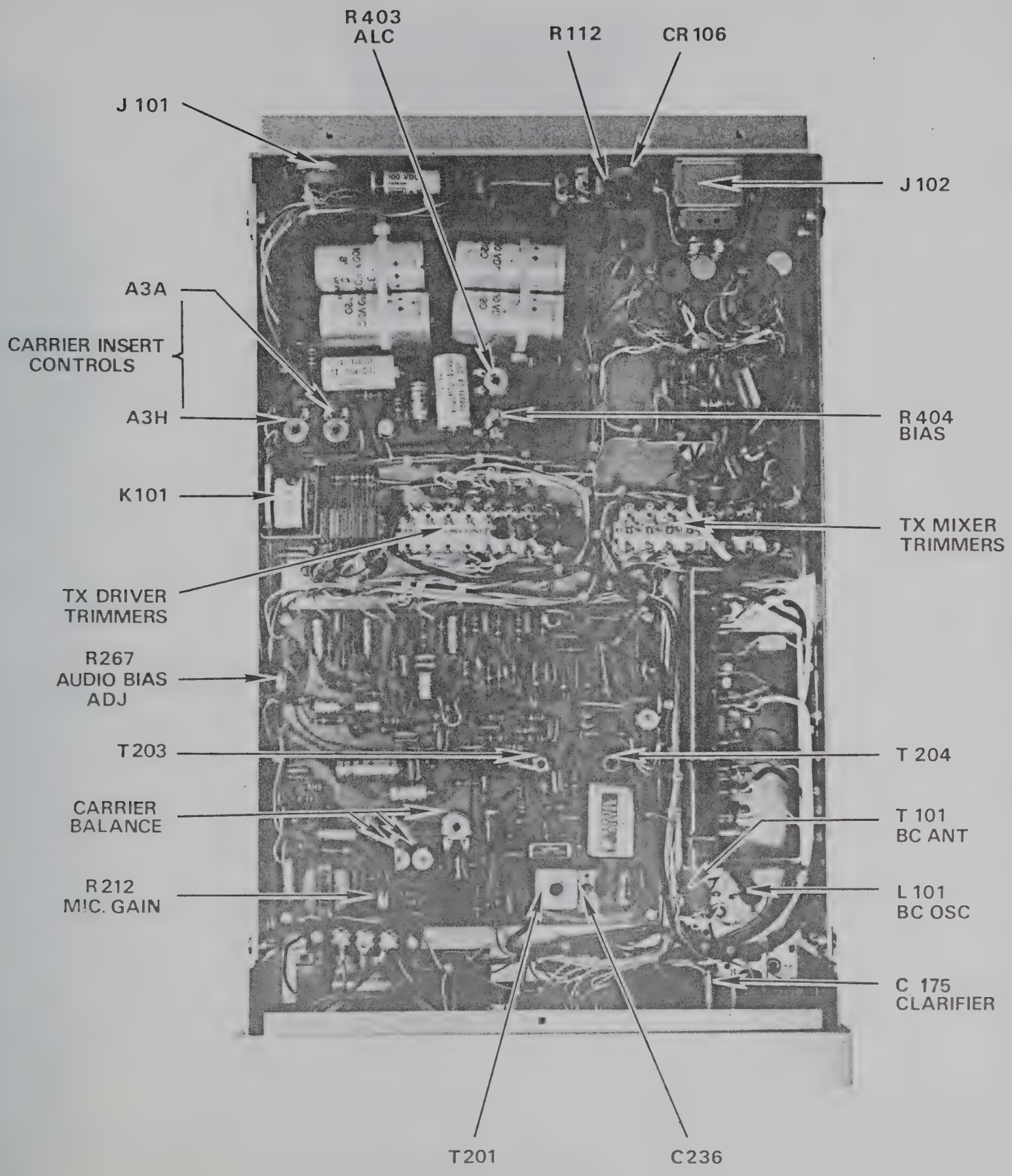
With the exception of the three tubes in the transmitter section of the KR-85SB, all components of the unit may be expected to perform indefinitely. Relay contacts may require occasional burnishing; evidence of faulty contacts is usually erratic operation of either the receiver or transmitter.

All circuits within the power supply are protected by fuses and these should be examined in the event of sudden malfunction. Never replace a fuse with one of a heavier rating since this can cause damage to other components.

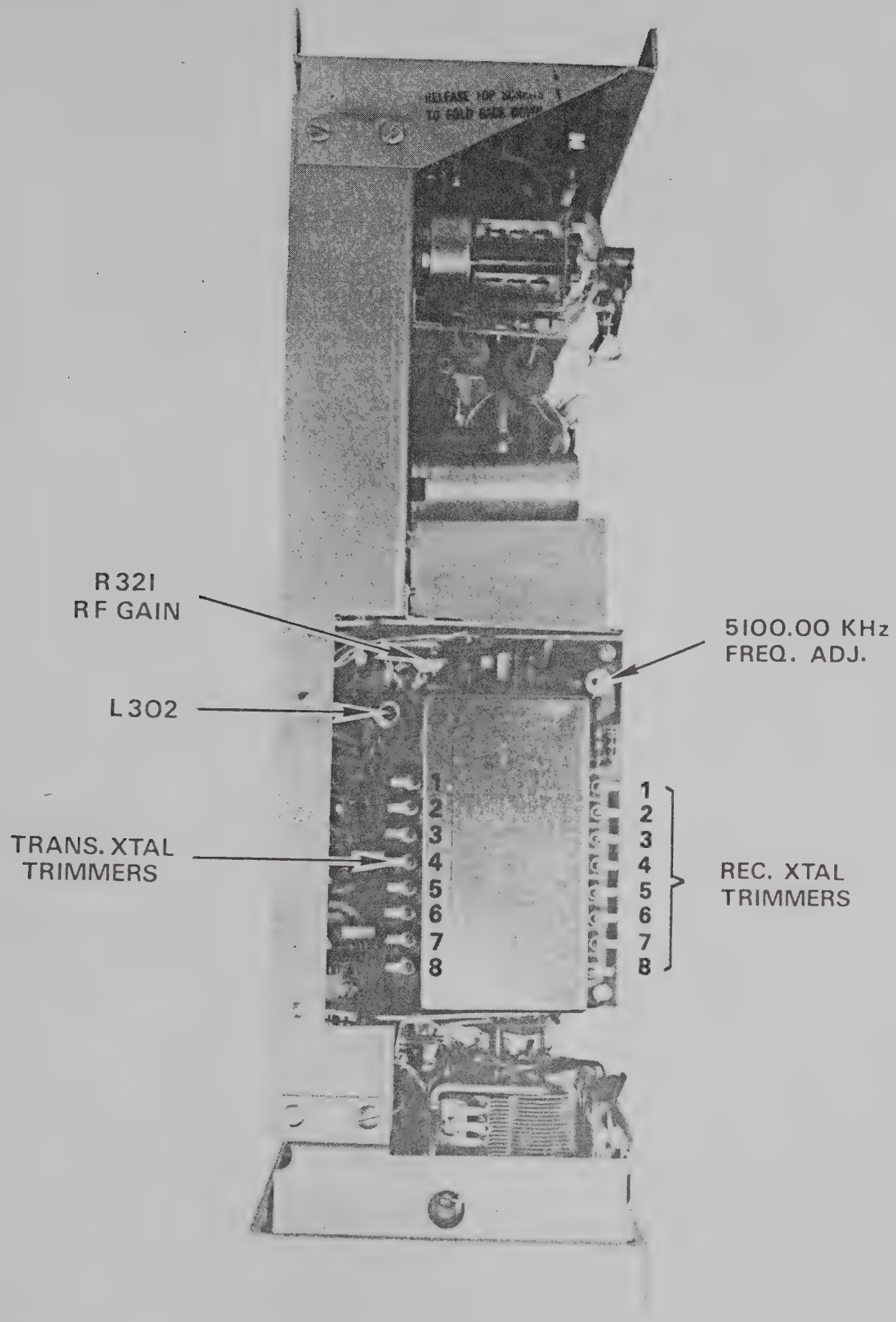
Important voltages are given on the circuit diagram contained in this manual. In the event of malfunction, voltages near the section suspected of faulty operation should be checked and any severe discrepancies investigated. Resistance measurements within a circuit are often misleading since the semi-conductors within that circuit can cause a false reading. Voltage measurements usually give a more accurate indication of the circuit condition.



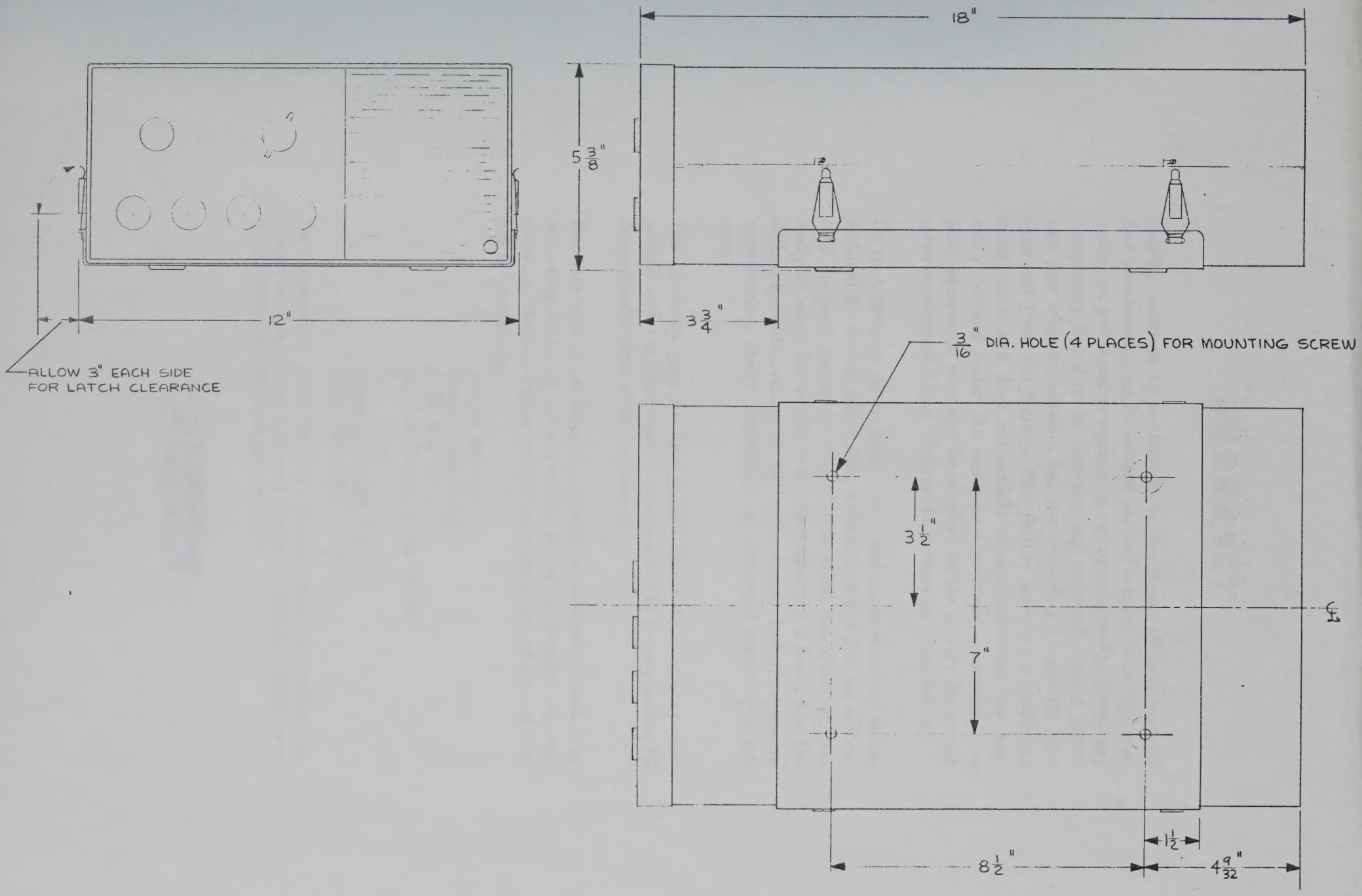
CHASSIS - TOP VIEW



CHASSIS - BOTTOM VIEW



OSCILLATOR - RF AMPLIFIER



OUTLINE MOUNTING DIMENSIONS

WARRANTY

KONEL warrants its products to be free from defects in material and workmanship under normal use and service. Under this warranty, we will repair or replace (at our option) free of charge any component found to be defective and returned prepaid within one year after installation, but not exceeding 15 months after shipment from the factory. This factory warranty is limited to components and does not include service technician time normally covered under the customer's purchase agreement. Complete equipment may also be returned to the factory for service when accompanied by a "Return Authorization" (See below).

On such items as tubes, lamps, fuses and accessories (not manufactured by Konel) which have a limited service life, we will extend the same guarantee as received from the manufacturer; generally 90 days. The warranty will be voided if it is found that the defects have been caused by alteration, misuse, lack of preventive maintenance, faulty installation or abnormal operating conditions.

This warranty may be held invalid unless the warranty card packed with the equipment is returned to the factory within 15 days of installation of the equipment.

Warranty service on Konel equipment is normally provided by the selling dealer. If, for any reason, this is not possible you may obtain a "Return Authorization" number or list of Service Dealers by contacting:

Service Manager
Konel Corporation
P. O. Box 2343
So. San Francisco, Ca. 94080
or
Phone (415) 588-3011
Telex 331-419 Konel SSF

The manufacturer reserves the right to make changes in specifications, designs, or prices without notice and without incurring any obligation to install changes on equipment previously sold.

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